



# Handling Robot in Clean Room MOTOMAN-MCL, MFL Series



Certified for  
ISO9001 and  
ISO14001



R009



JQA-0813



JQA-EM0924

# High-speed Handling of Large or Heavy Loads

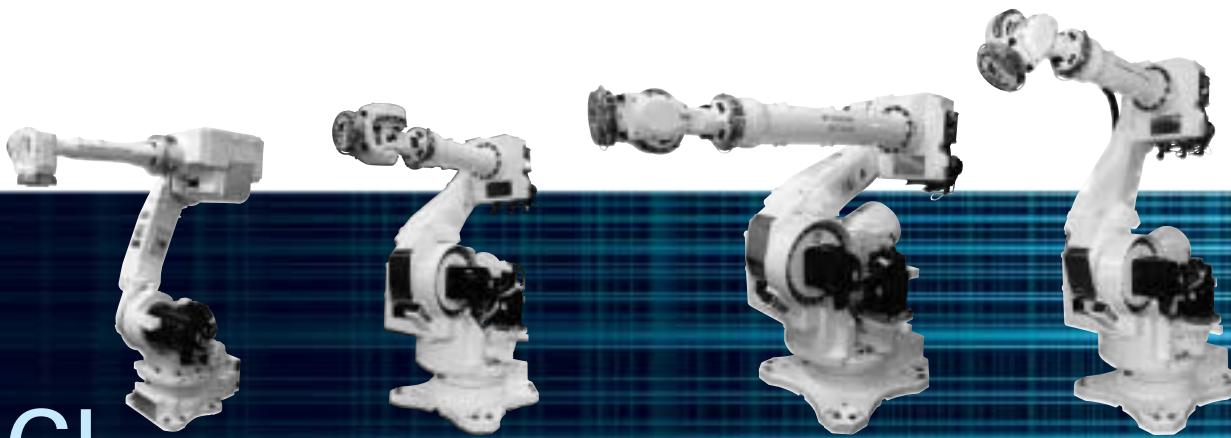
Handling in clean rooms can be automated and productivity improved.

## MOTOMAN-MCL Series

Vertically Articulated Robot with 6 axes

Robot postures can be easily changed. The robot can reverse or slant an object before placing on cassettes or other containers.

- A wide range of models are available
- High-speed handling of a large or heavy load with a wide range of motion



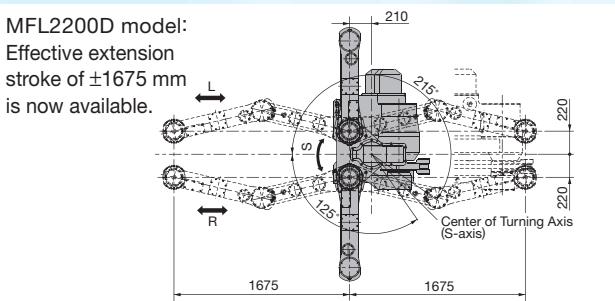
MOTOMAN-	MCL50	MCL130	MCL165-100	MCL165
Payload kg	50	130	100	165
Horizontal Reach mm	Min: 500; Max: 2046	Min: 729; Max: 2650	Min: 950; Max: 3001	Min: 729; Max: 2650
Vertical Reach mm (measured from the floor)	2441 <small>See p. 4</small>	3130 <small>See p. 5</small>	3480 <small>See p. 6</small>	3130 <small>See p. 7</small>

## MCL series

### Features of Horizontally Articulated Robots

#### 1 Flexible system layout in smaller space

An entire manipulator can be fit in the turning radius of a glass substrate. The horizontally articulated robots have a long up-and-down axis stroke with a low path line as well as a long pullback stroke so they can be installed at ideal locations for multi-level cassettes.



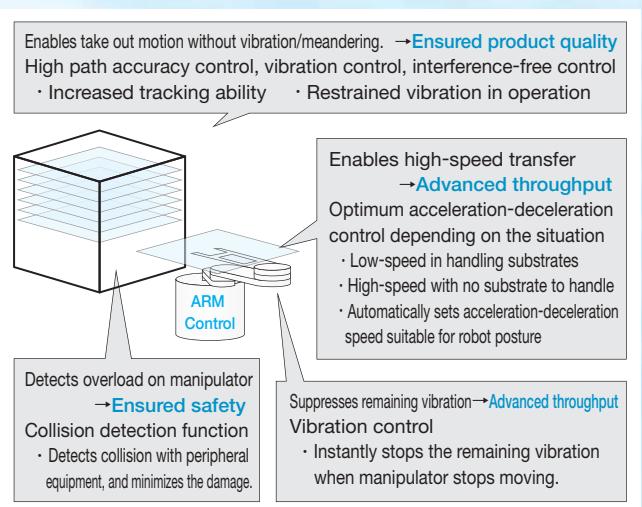
#### 2 Reduced running costs with high cleanliness

High cleanliness is ensured by using drive axes built with a high-reliability, enclosed structure. Running cost will be reduced, because maintenance is easy without the need for exhaust fans and filters.

#### 3 Variety of Useful Functions for Handling Large Glass Substrates

##### ●ARM (Advanced Robot Motion) Control

The ARM control enables high-speed and high-accuracy handling for high throughput.

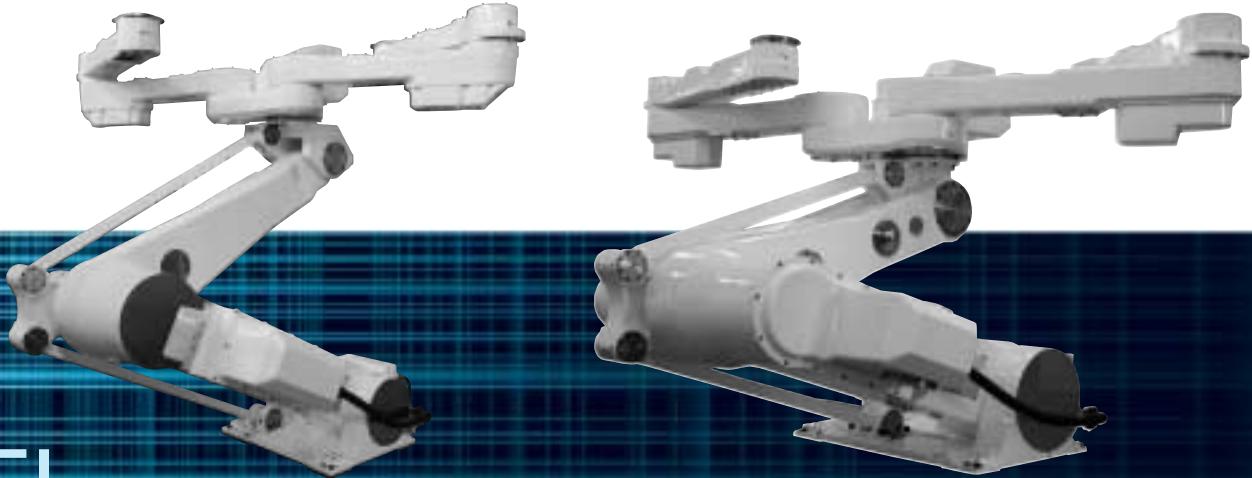


# MOTOMAN-MFL Series

Horizontally Articulated Robot with 4 Axes

Ideal systems can be built for a horizontal transfer in clean rooms.

- Response to glass substrate of the 6th & the 7th generations
- Installation in small space possible because of a shorter turning radius
- Long up-and-down stroke with a low path line



## MFL series

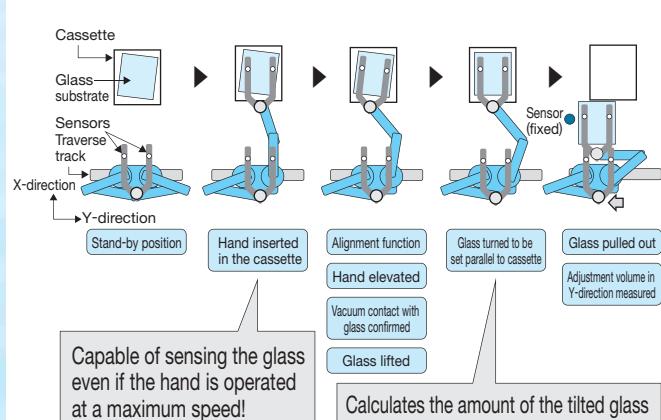
MOTOMAN-	MFL2200D -1840/-2440/-2650	MFL2400D -1800/-2400
Payload kg	50/arm (Single-arm model is also available.)	80/arm (Single-arm model is also available.)
Back-and-Forth Stroke mm	±1675	±2240
Up/Down Axis Motion Range mm	Three types: 1840, 2440, and 2650	Two types: 1800 and 2400

See p. 8

See p. 9

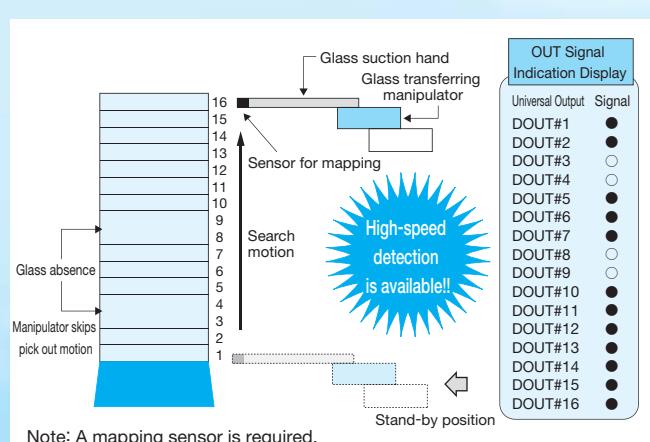
### ● Alignment Function (Option)

- No alignment devices required.
- Enables high-speed detection without stopping the manipulator in detecting glass position.



### ● Mapping Function (Option)

- Enables high-speed detection from bottom to top of the cassette. Reduces cycle time by skipping pick up motions for blank space in the cassette.
- Enables high-speed communication with an interface to other devices including your host computer.



# MOTOMAN-MCL50

6-Axis vertically articulated robot, 50 kg payload



## Wide range of motion for heavy-weight handling

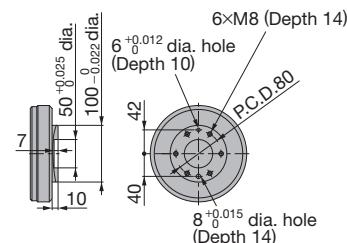
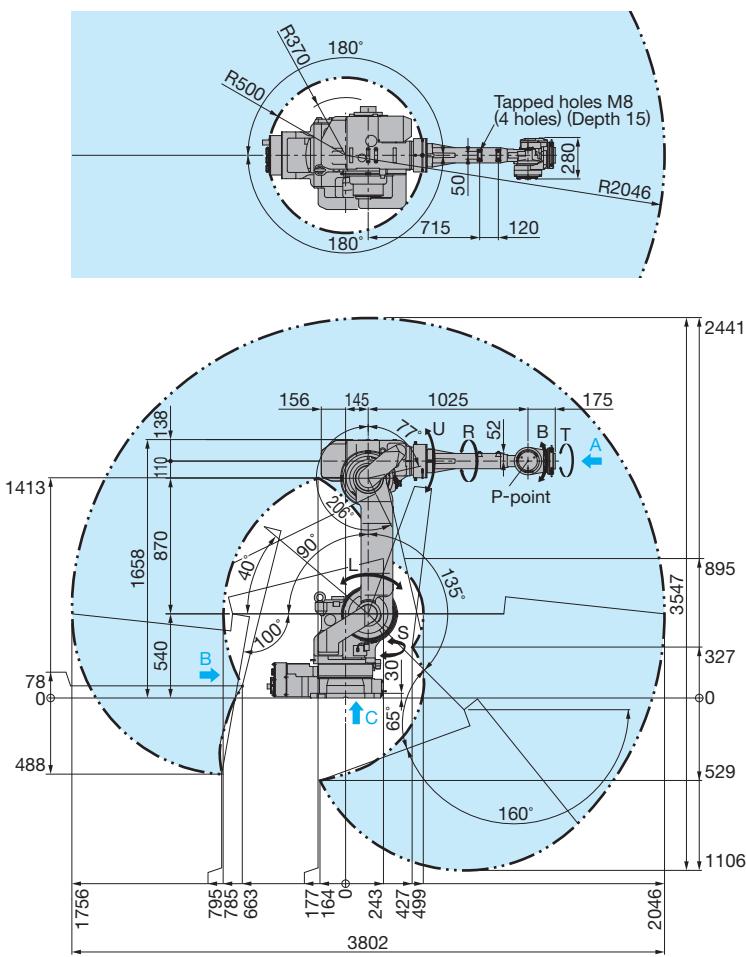
Heavy weight handling is achieved because of the high degree of freedom and the wide working envelope (R2046 mm).

ISO  
Class  
**5**

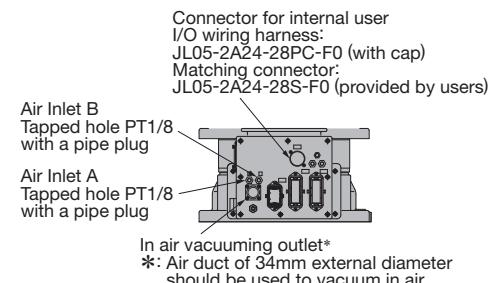
## Space-saving

The small radius of the interference area (R370 mm) saves installation space and makes the design of the system layout more flexible.

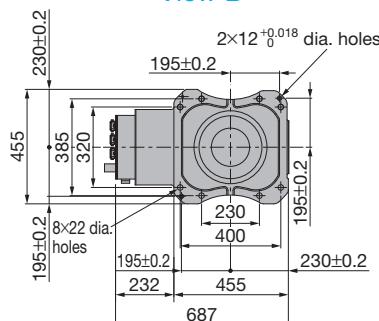
**Dimensions** Unit : mm    : P-point Maximum Envelope



View A



View B



View C

## Manipulator Specifications

Model	MOTOMAN-MCL50	
Type	YR-MCL0050-A00	
Structure	Vertically articulated, 6 degrees of freedom	
Payload	50 kg	
Repeatability*1	±0.07 mm	
Range of Motion	S-axis (turning)	-180° - +180°
	L-axis (lower arm)	-90° - +135°
	U-axis (upper arm)	-160° - +260°
	R-axis (wrist roll)	-360° - +360°
	B-axis (wrist pitch/yaw)	-125° - +125°
	T-axis (turning)	-360° - +360°
Maximum Speed	S-axis (turning)	2.97 rad/s, 170°/s
	L-axis (lower arm)	2.97 rad/s, 170°/s
	U-axis (upper arm)	2.97 rad/s, 170°/s
	R-axis (wrist roll)	3.49 rad/s, 200°/s
	B-axis (wrist pitch/yaw)	3.32 rad/s, 190°/s
	T-axis (turning)	4.36 rad/s, 250°/s
Allowable Moment		196 N·m
Allowable Inertia (GD <sup>2</sup> /4)		196 N·m
T-axis (turning)		127 N·m
Painting Color		Munsell notation N9.5 or equivalent
Approx. Mass		550 kg
Clean Class*2		ISO class 5
Ambient Conditions	Temperature	+15 to +35°C
	Humidity	20% to 80%RH (non-condensing)
	Vibration	4.9 m/s <sup>2</sup> or less
	Others	<ul style="list-style-type: none"> <li>• Free from corrosive gasses or liquids, or explosive gasses</li> <li>• Clean and dry</li> <li>• Free from excessive electrical noise</li> </ul>
Power Requirement *3		4.5 kVA

\*1 : Conforms to JIS B 8432.

\*2 : Conforms to ISO-14644 standards (The above of the wrist flange surrounded by a down flow of 0.4m/s or more.)

\*3 : Power requirement varies in accordance with applications and motion patterns.

Note : SI units are used for specifications.

# MOTOMAN-MCL130

6-Axis vertically articulated robot, 130 kg payload



## Excellent handling performance with high degree of freedom

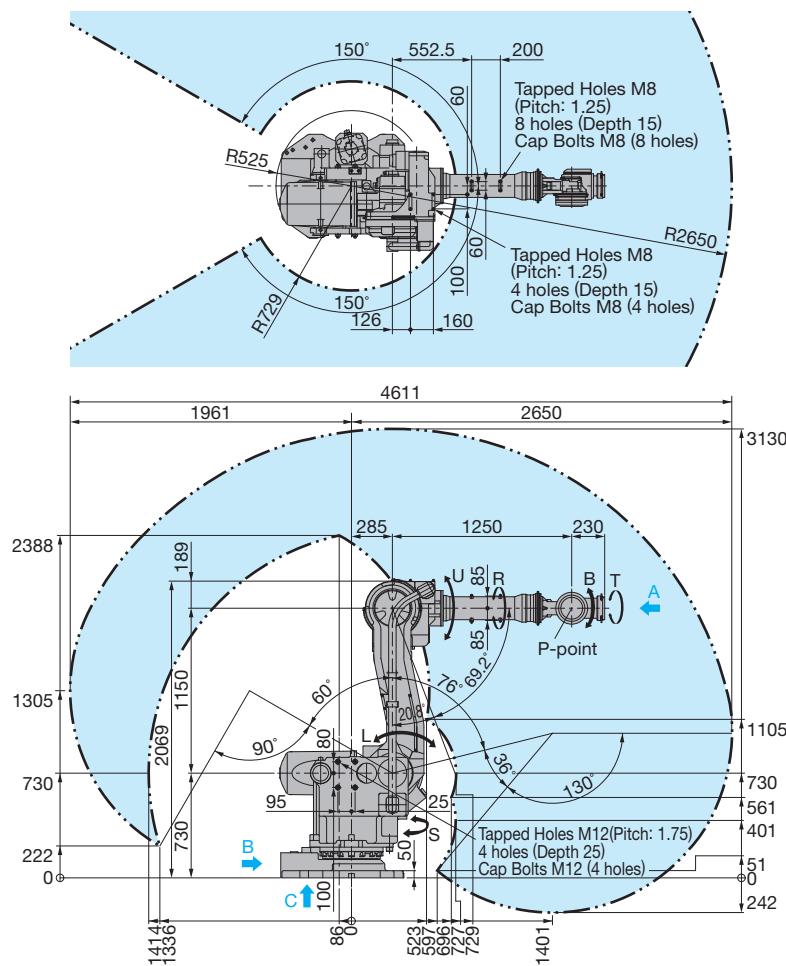
The MOTOMAN-CR130 and -CR165 are 6-axes, vertically articulated robots with 130-kg or 165-kg payloads and can handle heavy workpieces at high speeds while changing orientation.

## Wide range of motion for flexible system layout

The MOTOMAN-CR130/CR-165, with a maximum reach of 2650 mm and a maximum height of 3130 mm, can transfer workpieces from a position that is lower and closer than ever to another position that is higher and farther away than ever before, so a flexible system layout is possible.

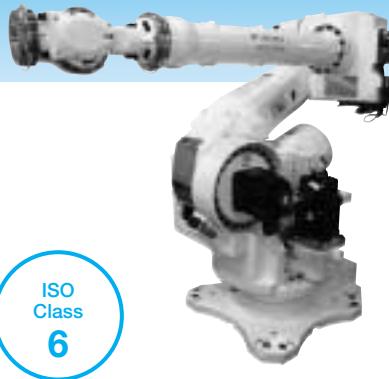
ISO  
Class  
**6**

**Dimensions** Unit : mm    : P-point Maximum Envelope



# MOTOMAN-MCL165-100

## 6-Axis vertically articulated robot, 100 kg payload

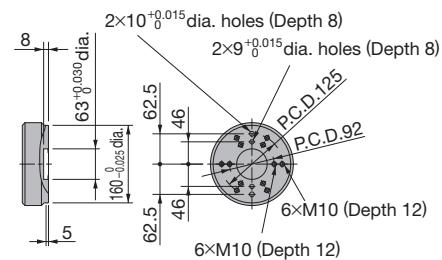
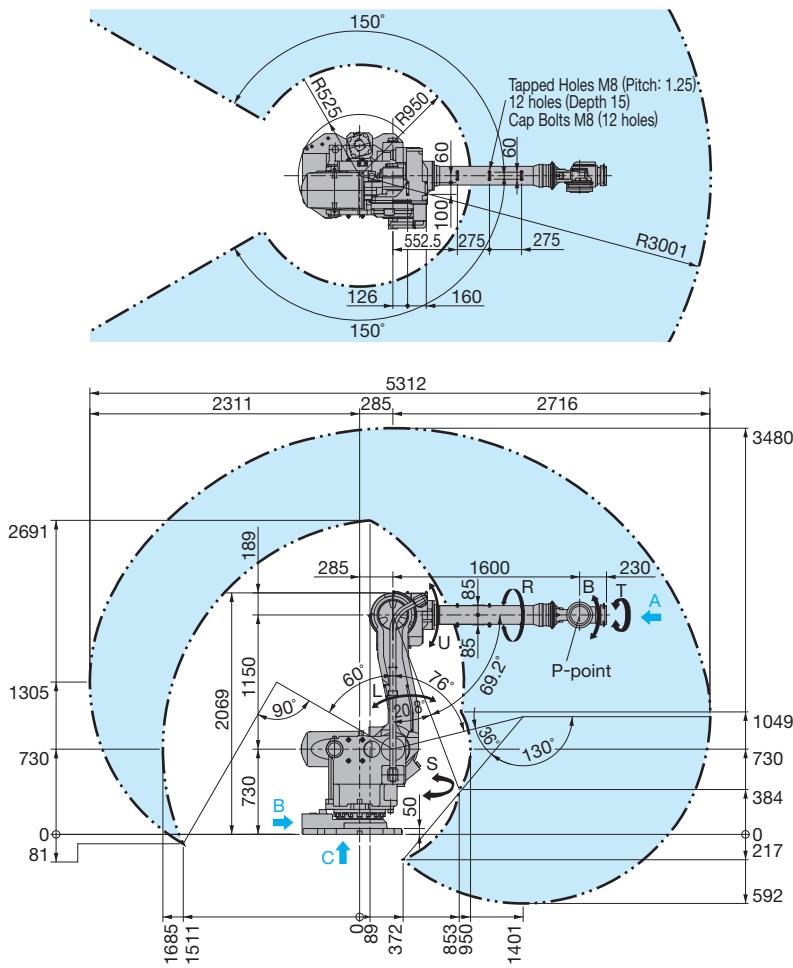


## Heavy-load handling with a wide range of motion

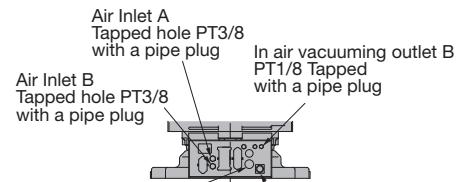
The handling of heavy loads can be easily automated and efficiency greatly improved with the MOTOMAN-MCL165-100, featuring a high payload (100 kg) and a wide motion range (radius: 3001 mm).

ISO  
Class  
**6**

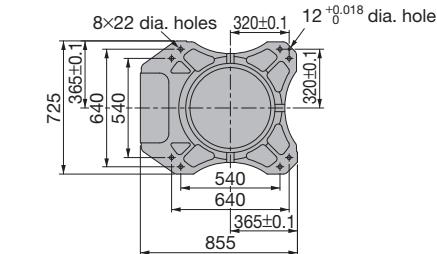
**Dimensions** Unit : mm  : P-point Maximum Envelope



## View A



## View B



### View C

## Manipulator Specifications

Model	MOTOMAN-MCL165-100	
Type	YR-MCL0165-A10	
Structure	Vertically articulated, 6 degrees of freedom	
Payload	100 kg	
Repeatability* <sup>1</sup>	±0.3 mm	
Range of Motion	S-axis (turning)	-150° - +150°
	L-axis (lower arm)	-60° - +76°
	U-axis (upper arm)	-130° - +240°
	R-axis (wrist roll)	-360° - +360°
	B-axis (wrist pitch/yaw)	-130° - +130°
	T-axis (turning)	-360° - +360°
Maximum Speed	S-axis (turning)	1.92 rad/s, 110°/s
	L-axis (lower arm)	1.92 rad/s, 110°/s
	U-axis (upper arm)	1.92 rad/s, 110°/s
	R-axis (wrist roll)	3.05 rad/s, 175°/s
	B-axis (wrist pitch/yaw)	2.53 rad/s, 145°/s
	T-axis (turning)	4.19 rad/s, 240°/s

Allowable Moment	R-axis (wrist roll) B-axis (wrist pitch/yaw) T-axis (turning)	833 N·m 833 N·m 490 N·m
Allowable Inertia (GD <sup>2</sup> /4)	R-axis (wrist roll) B-axis (wrist pitch/yaw) T-axis (turning)	75 kg·m <sup>2</sup> 75 kg·m <sup>2</sup> 25 kg·m <sup>2</sup>
Painting Color		Munsell notation N9.5 or equivalent
Approx. Mass		1325 kg
Clean Class <sup>*2</sup>		ISO class 6
Ambient Conditions	Temperature	+15 to +35°C
	Humidity	20% to 80%RH (non-condensing)
	Vibration	4.9 m/s <sup>2</sup> or less
	Others	<ul style="list-style-type: none"> <li>• Free from corrosive gasses or liquids, or explosive gasses</li> <li>• Clean and dry</li> <li>• Free from excessive electrical noise</li> <li>• The flatness of the mounting surface must be 0.5mm or less.</li> </ul>
	Power Requirement <sup>*3</sup>	6.0 kVA

\*1 : Conforms to JIS B 8432

\*2 : Conforms to ISO-14644 standards (The above of the wrist flange surrounded by a down flow of 0.4m/s or more.)

\*3 : Power requirement varies in accordance with applications and motion patterns.

# MOTOMAN-MCL165

6-Axis vertically articulated robot, 165 kg payload

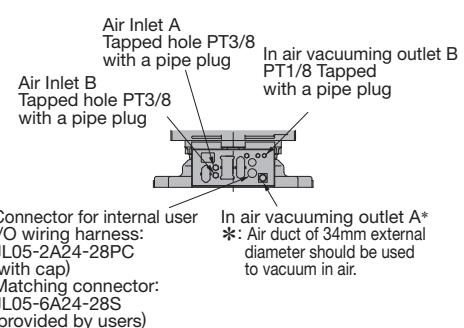
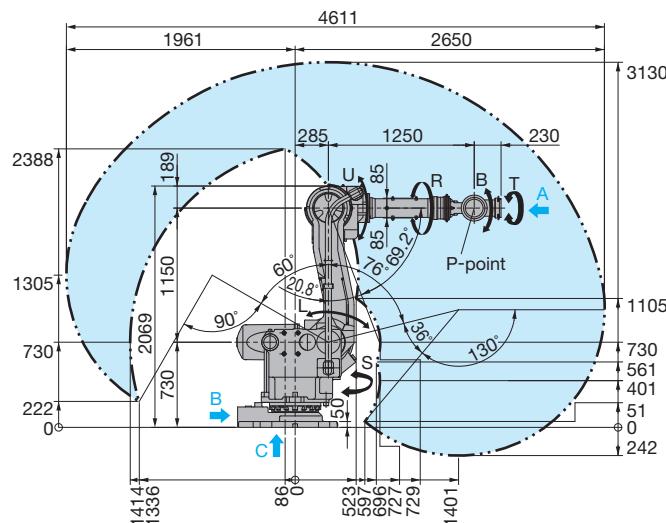
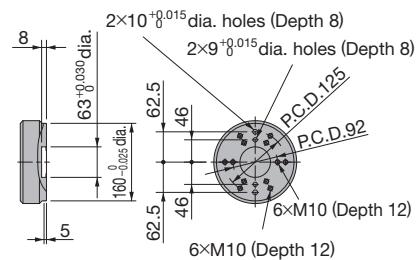
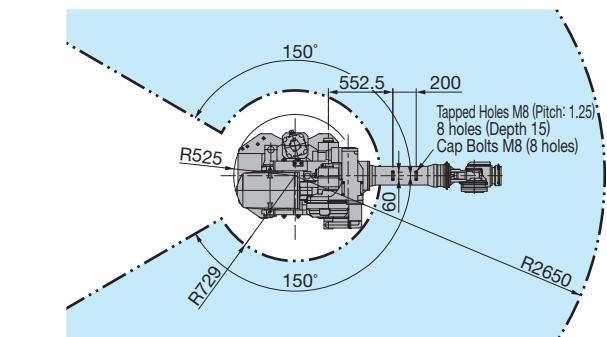


## Ideal robot for handling large or heavy loads

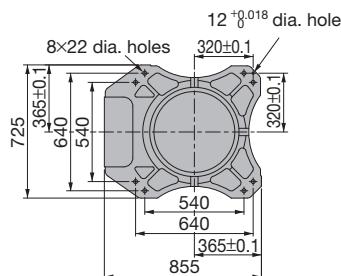
With a high payload of 165 kg, the MOTOMAN-MCL165 is the perfect robot for handling heavy loads. System layouts can be custom designed, because the robot can handle heavy loads with a wide range of motion. The MCL165 has a maximum radial reach of 2650 mm and a maximum horizontal reach of 3130 mm.

ISO  
Class  
**6**

**Dimensions** Unit : mm     : P-point Maximum Envelope



View B



View C

## Manipulator Specifications

Model	MOTOMAN-MCL165	
Type	YR-MCL0165-A00	
Structure	Vertically articulated, 6 degrees of freedom	
Payload	165 kg	
Repeatability*1	±0.2 mm	
Range of Motion	S-axis (turning)	-150° - +150°
	L-axis (lower arm)	-60° - +76°
	U-axis (upper arm)	-130° - +240°
	R-axis (wrist roll)	-360° - +360°
	B-axis (wrist pitch/yaw)	-130° - +130°
	T-axis (turning)	-360° - +360°
	S-axis (turning)	1.92 rad/s, 110°/s
Maximum Speed	L-axis (lower arm)	1.92 rad/s, 110°/s
	U-axis (upper arm)	1.92 rad/s, 110°/s
	R-axis (wrist roll)	3.05 rad/s, 175°/s
	B-axis (wrist pitch/yaw)	2.53 rad/s, 145°/s
	T-axis (turning)	4.19 rad/s, 240°/s

Allowable Moment	R-axis (wrist roll)	883 N·m
	B-axis (wrist pitch/yaw)	883 N·m
	T-axis (turning)	490 N·m
Allowable Inertia (GD²/4)	R-axis (wrist roll)	51.25 kg·m²
	B-axis (wrist pitch/yaw)	51.25 kg·m²
	T-axis (turning)	15 kg·m²
Painting Color	Munsell notation N9.5 or equivalent	
Approx. Mass	1300 kg	
Clean Class*2	ISO class 6	
Ambient Conditions	Temperature	+15 to +35°C
	Humidity	20% to 80%RH (non-condensing)
	Vibration	4.9 m/s² or less
	Others	<ul style="list-style-type: none"> <li>Free from corrosive gasses or liquids, or explosive gasses</li> <li>Clean and dry</li> <li>Free from excessive electrical noise</li> <li>The flatness of the mounting surface must be 0.5mm or less.</li> </ul>
Power Requirement*3	6.0 kVA	

\*1 : Conforms to JIS B 8432.

\*2 : Conforms to ISO-14644 standards (The above of the wrist flange surrounded by a down flow of 0.4m/s or more.)

\*3 : Power requirement varies in accordance with applications and motion patterns.

Note: SI units are used for specifications.

# MOTOMAN-MFL2200D-2650

4-Axis horizontally articulated robot, 50 kg/arm payload



ISO  
Class  
**4**

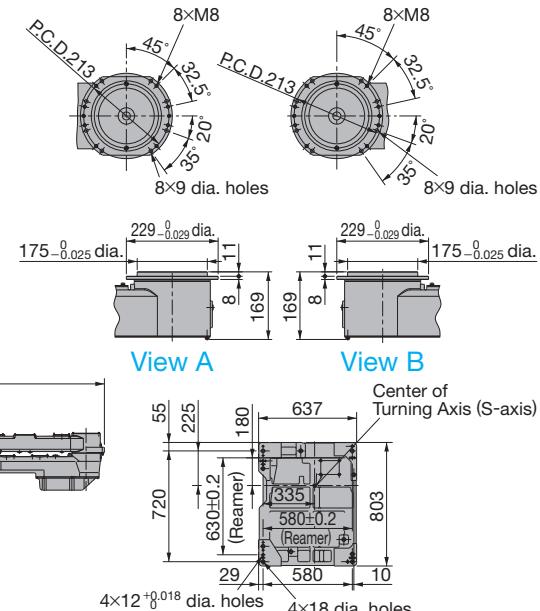
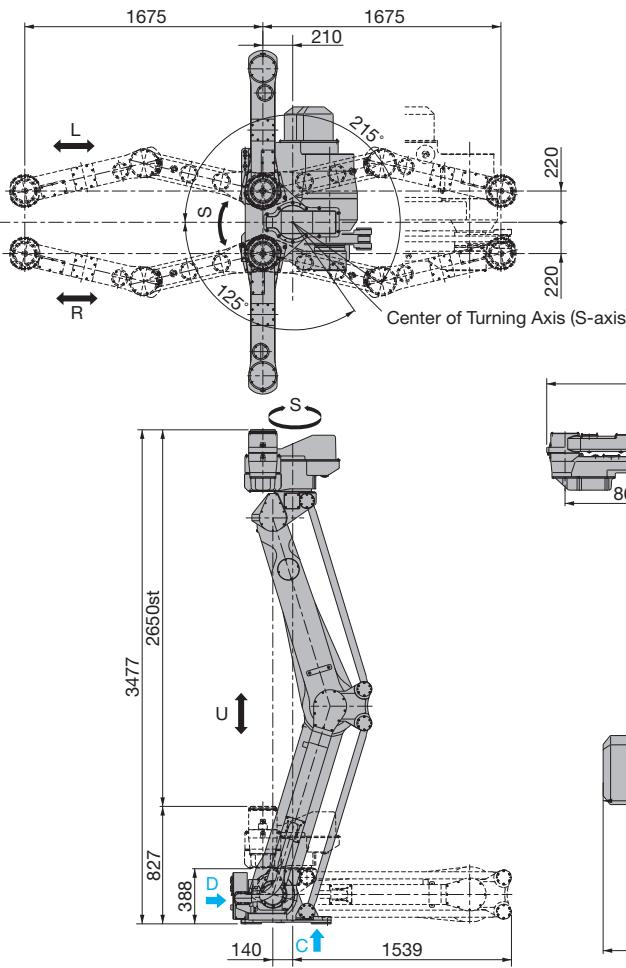
## High-speed transfer to multi-level cassettes

The horizontally articulated robots can handle the 6th generation of glass substrates (1500 mm × 1850 mm). Large LCD glass substrates can be loaded to or unloaded from multi-level cassettes at high speeds by using a long up-and-down stroke (1840 mm, 2440 mm, or 2650 mm), a low path line, and double arms.

Single-armed model is also available.

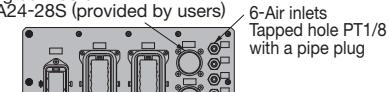
## Dimensions Unit : mm

P-point Maximum Envelope



## View C

Connector for internal user  
I/O wiring harness: JL05-2A24-28PC (with cap)  
Matching connector:  
JL05-6A24-28S (provided by users)



Connector for internal user  
I/O wiring harness: JL05-2A24-28PCW (with cap)  
Matching connector:  
JL05-6A24-28SW (provided by users)

## View D

## Manipulator Specifications

Model	MOTOMAN-MFL2200D-2650			
Type	YR-MFL050D-A20			
Structure	Horizontally articulated, 4 degrees of freedom			
Payload	50kg/arm			
Repeatability*1	±0.2 mm			
Range of Motion	U-axis (up/down)	2650 mm		
	S-axis (turning)	-215° - +125°		
	L-, R-axis (sideways)	-1675 mm - +1675 mm		
Maximum Speed	U-axis (up/down)	1330 mm/s max.		
	S-axis (turning)	3.14 rad/s, 180°/s		
	L-, R-axis (sideways)	3250 mm/s max.		
Allowable Moment	L-, R-axis (sideways)	250 N·m		
Allowable Inertia (GD <sup>2</sup> /4)		L-, R-axis (sideways)	50 kg·m <sup>2</sup>	
Painting Color		Munsell notation N9.5 or equivalent		
Approx. Mass		1020 kg		
Clean Class*2		ISO class 4		
Ambient Conditions	Temperature	+15 to +25°C		
	Humidity	20% to 80%RH (non-condensing)		
	Vibration	4.9 m/s <sup>2</sup> or less		
	Others	<ul style="list-style-type: none"> <li>• Free from corrosive gasses or liquids, or explosive gasses</li> <li>• Clean and dry</li> <li>• Free from excessive electrical noise</li> <li>• The flatness of the mounting surface must be 0.5mm or less.</li> </ul>		
Power Requirement*3		3.5 kVA		

\*1 : Conforms to JIS B 8432.

\*2 : Conforms to ISO-14644 standards (The above of the wrist flange surrounded by a down flow of 0.4m/s or more.)

\*3 : Power requirement varies in accordance with applications and motion patterns.

Note: SI units are used for specifications.

# MOTOMAN-MFL2400D-2400

4-Axis horizontally articulated robot, 80 kg/arm payload

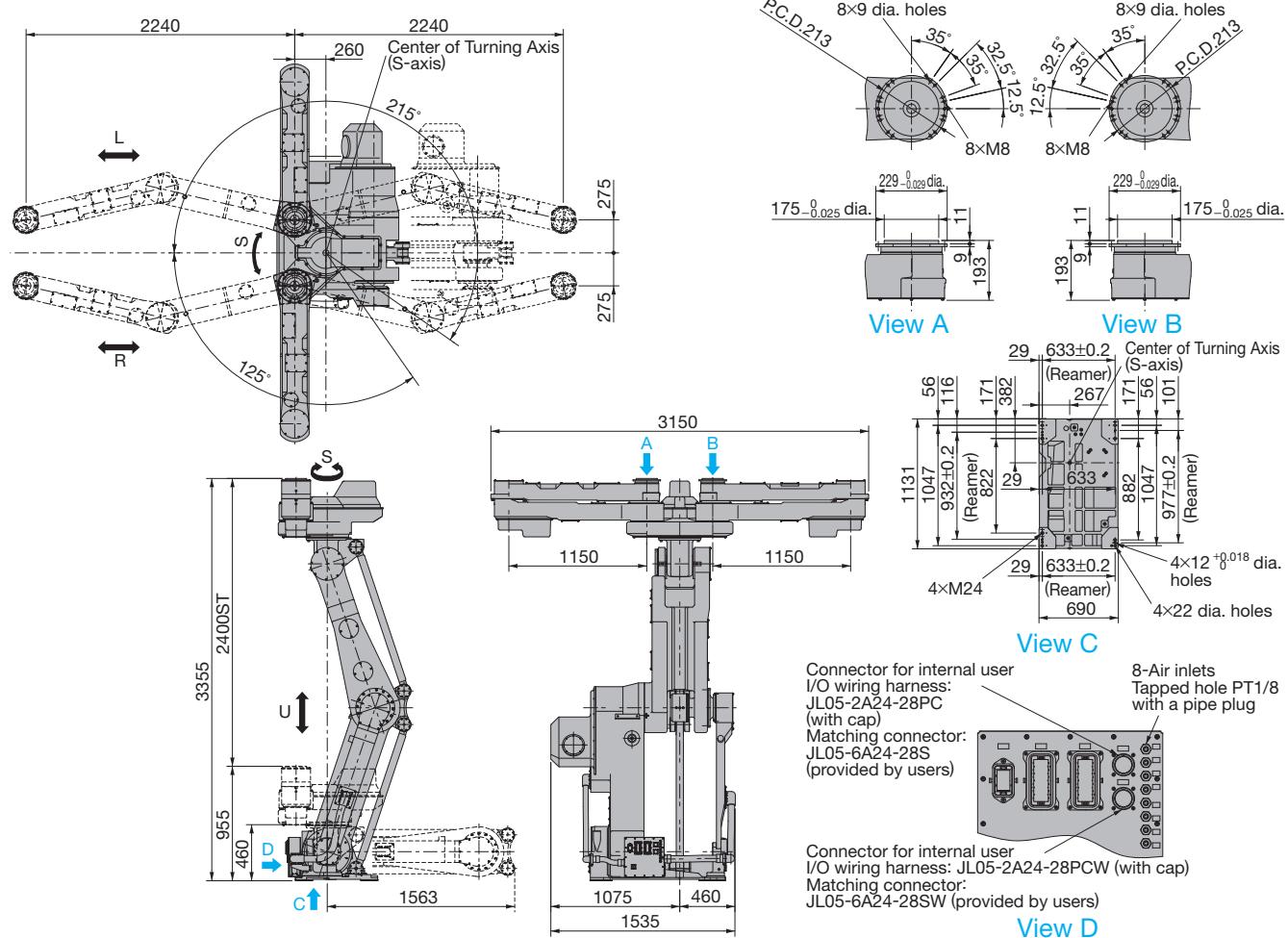


#### **Flexible handling system for different levels of cassettes**

The horizontally articulated robots can handle the 7th generation of glass substrates (1870 mm × 2200 mm). Large LCD glass substrates can be handled with double arms at a maximum speed of 3600 mm/s. A wide range of motion is realized with a low path line and a long up-and-down stroke (1800 mm or 2400 mm). These features contribute to higher throughput.

Single-armed model is also available.

**Dimensions** Unit : mm  : P-point Maximum Envelope



## Manipulator Specifications

Model	MOTOMAN-MFL2400D-2400				
Type	YR-MFL080D-A10				
Structure	Horizontally articulated, 4 degrees of freedom				
Payload	80kg/arm				
Repeatability* <sup>1</sup>	$\pm 0.2$ mm				
Range of Motion	U-axis (up/down)	2400 mm			
	S-axis (turning)	$-215^\circ \text{ - } +125^\circ$			
	L-, R-axis (sideways)	$-2240 \text{ mm} \text{ - } +2240 \text{ mm}$			
Maximum Speed	U-axis (up/down)	1000 mm/s max.			
	S-axis (turning)	3.14 rad/s, $180^\circ/\text{s}$			
	L-, R-axis (sideways)	3600 mm/s max.			
Allowable Moment	L-, R-axis (sideways)	410 N·m			
Ambient Conditions	Allowable Inertia (GD <sup>2</sup> /4)	L-, R-axis (sideways)			
	Painting Color				
	Approx. Mass				
	Clean Class* <sup>2</sup>				
	Temperature	ISO class 4			
		$+15 \text{ to } +25^\circ\text{C}$			
		Humidity 20% to 80%RH (non-condensing)			
Power Requirement* <sup>3</sup>	Vibration 4.9 m/s <sup>2</sup> or less				
	Others	• Free from corrosive gasses or liquids, or explosive gasses			
		• Clean and dry			
		• Free from excessive electrical noise			
	• The flatness of the mounting surface must be 0.5mm or less.				
Power Requirement* <sup>3</sup>			5.0 kVA		

\*1 : Conforms to JIS B 8432.

\*2 : Conforms to ISO-14644 standards (The above of the wrist flange surrounded by a down flow of 0.4m/s or more.)

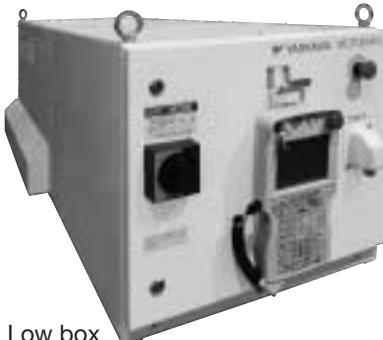
\*3 : Power requirement varies in accordance with applications and motion patterns.

Note: SI units are used for specifications.

# Robot Controller DX100 (Designed for use in clean rooms)

Robot controller can control up to 72 axes (8 robots). Its higher instruction processing speed, increased functions, and slim profile minimize the space required for production equipment and improve productivity.

The multi-window display function is added to the amazingly small and lightweight programming pendant to largely improve operability. The speed reducer life analysis function and troubleshooting function are also provided to reduce maintenance time.



Low box



Tall box

## ■ Specifications

Controller	Configuration	Dust proof
	Dimensions*	Tall box : 800 mm (W) × 900 mm (H) × 550 mm (D) Low box : 600 mm (W) × 550 mm (H) × 1500 mm (D)
	Mass	200kg
	Cooling System	Indirect cooling
	Ambient Temperature	During operation : 0°C to +25°C / During storage : -10°C to +60°C
	Relative Humidity	90% max. (non-condensing)
	Power Supply	Three-phase 200/220 VAC (+10% to -15%) at 60 Hz (Japan) Three-phase 200 VAC (+10% to -15%) at 50 Hz (Japan)
	Grounding	Grounding resistance : 100Ω or less
	Digital I/Os	Specialized signals : 23 inputs and 5 outputs General signals : 40 inputs and 40 outputs Max.I/O (optional) : 2048 inputs and 2048 outputs
	Positioning System	By serial encoder
	Programming Capacity	JOB : 200,000 steps, 10,000 instructions CIO ladder : 20,000 steps max.
	Expansion Slots	PCI : 2 slots for main CPUs, 1 slot for servo CPU and 1 additional slot for sensor board
	LAN (Connection to Host)	1 (10BaseT/100BaseTX)
	Interface	RS-232C : 1ch
	Control Method	Software servo control
	Drive Units	For robot axes : One drive unit for AC servo with 6 axes For external axes : Optional
	Painting Color	Munsell notation 5Y 7/1 (reference value)

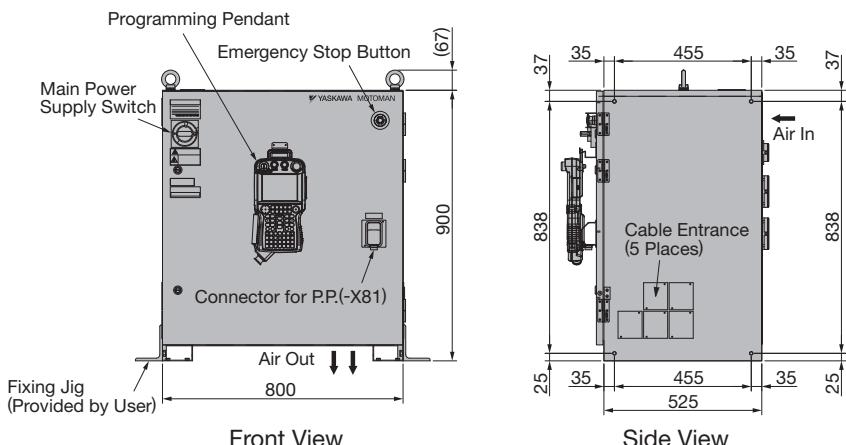
\* : Does not include protruding parts.

## ■ Functions

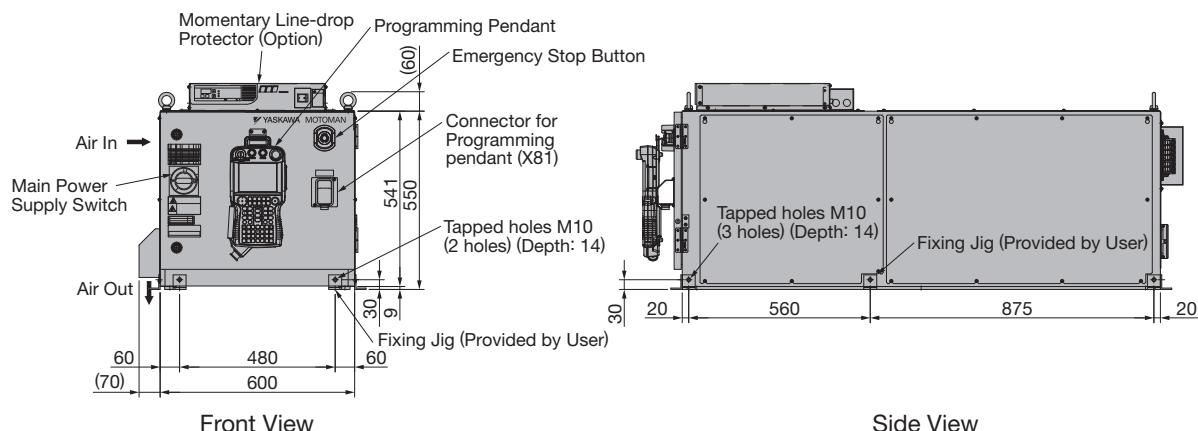
Operation	Coordinate System	Includes joint, rectangular/cylindrical, tool, and user coordinates
	Modification of Teaching Points	Adding, deleting or correcting robot axes and external axes.
	Inching Operation	Allows inching
	Locus Confirmation	Includes forward/reverse and continuous feeding
	Speed Adjustment	Allows automatic speed adjustment to match cycle time
	Timer Setting	Possible every 0.01s
	Short-cut Function	Includes direct-open function, multi-window display function, touch panel
	Interface	RS-232C (1ch) for FC1/FC2, one CF card, and USB memory
	Application Supported	Arc welding, spot welding, handling, general, jig-less, etc.
	Essential Measures	Japanese Industrial Standard (JIS)
Safety Features	Teach Lock Mode	Prohibits playback panel operation during teaching
	Collision Proof Frames	Includes doughnut-sector frame, cubic frame (user coordinates)
	Self-diagnosis	Classifies errors and two types of alarms (major and minor) and displays the data
	User Alarm Display	Displays alarm messages for peripheral devices
	Machine Lock	Allows test-run of peripheral devices without robot motion
	Door Interlock	Allows door to open only when main power switch is OFF.
	System Monitoring	Controls power-ON time, servo power-ON time, playback time, moving time, operating time
Maintenance Functions	Time Display	Displays alarm messages including troubleshooting, and alarm history
	Alarm Display	Provides simulated enabled/disabled output possible
	I/O Diagnosis	Automatically calibrates parameters for end effectors
	T.C.P. Calibration	Interactive Programming
	Programming Language	Robot language: INFORM III
	Robot Motion Control	Includes joint coordinates, linear/circular interpolation, and tool coordinates
	Speed Setting	Uses percentage for joint coordinates, 0.1 mm/s, for interpolations, angular velocity for TCP fixed motion
Programming Functions	Program Control Instruction	Includes jump, call, timer, pause, execution of some instructions during robot motion
	Device Instructions	Includes device instruction corresponding to each application (ARCON, ARCOFF etc.)
	Variables	Global, local variables
	Types	Byte, integer, double integer, real, character, position
	I/O Instructions	Includes discrete I/O control and pattern I/O processing
	Global Standard	CE marking (optional)

## ■ Dimensions mm

- Tall box



- Low box



## Programming Pendant

The special programming pendant for robots in the MOTOMAN-MCL and -MFL series has a touch panel with many icons and pictures for greater visibility and operability. The programming pendant can significantly improve efficiency in debugging at startup.



## ■ Specifications

Dimensions	169 (W) × 314.5 (H) × 50 (D) mm
Mass	0.990kg
Material	Reinforced plastics
Operation Device	Select keys, axes keys, numerical/application keys, mode selector switch with keys (mode : teach, play, and remote), emergency stop button, enable switch, compact flash card interface device (compact flash is optional.), USB memory interface device
Display	5.7-inch color LCD, touch panel 640×480 pixels (Alphanumeric characters, Chinese characters, Japanese letters, Others)
IEC Protection Class	IP65
Cable Length	Standard: 8 m, Max.: 36 m (with optional extension cable)

# MOTOMAN-MCL, MFL Series

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YASKAWA ELECTRIC CORPORATION

In the event that the end user of this product is to be the military and said product is to be employed in any weapons systems or the manufacture thereof, the export will fall under the relevant regulations as stipulated in the Foreign Exchange and Foreign Trade Regulations. Therefore, be sure to follow all procedures and submit all relevant documentation according to any and all rules, regulations and laws that may apply.

Specifications are subject to change without notice  
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